E/CONF.39/D/28
29 Sept. 1962
ORIGINAL : ENGLISH

UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: D.4.1

United Kingdom

THE ASSESSMENT OF THE HEALTH HAZARD TO CONSUMERS ARISING FROM THE USE OF CHEMICALS IN FOOD : PROCESSING AND PRESERVATION

By L. GOLBERG, D.Sc., D.Ph., M.A., M.B., B.Chir., F.R.I.C.

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

3. Summaries of all papers, as submitted by contributors, will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

4. Papers and summaries will not be available for general distribution in advance of the Conference. They will be published in advance in limited quantities only for the use of delegations of participating governments and of other authorized participants. Post-Conference publication and general distribution of the Conference Proceedings will follow United Nations practices as laid down by the United Nations Publications Board.

"The assessment of the health hazard to consumers, arising from the use of chemicals in food processing and preservation"

by L. Golberg, D.Sc., D.Phil., M.A., M.B., B. Chir., F.R.I.C.

General principles regulating the addition of chemicals to food

1. To those whose problem it is to provide their people with an adequate level of nutrition, or at the very least a minimum of essential nutrients, this contribution may at first sight appear painfully academic. I can assure them that what I have to say is of concern to every minister, legislator and administrator grappling with the difficulty of making all possible use of scientific and technological advances without at the same time endangering in new, hidden and unexpected ways the health of the people he is trying to benefit.

2. In Britain, our attitude to chemicals in food and agriculture is mildly schizophrenic. A chemical which will help the farmer is welcomed with open arms, and an admirable Notification Scheme as well as other forms of administrative and scientific assistance exist to facilitate the safe introduction of a new pesticide or herbicide (1) Contrast this with the attitude enjoined by our Food and Drugs Acts which is to restrict 'so far as practicable the use in food of substances of no nutritional value' (2) Thus chemicals to help the food manufacturer are regarded as fundamentally undesirable: only an unavoidable minimum number of these can be permitted, under severely circumscribed conditions. This uncompromising attitude may serve the 'affluent societies' of the West well enough. The rest of mankind may perhaps be forgiven for adopting a less critical and more appreciative outlook on food additives of all kinds; for there can be no question regarding the benefits conferred by such additives in helping to grow more and better food, in preventing losses by spoilage and thereby facilitating nutritional improvement in difficult environments.

3. We are concerned firstly with chemicals which are added to food directly to preserve them, to prevent oxidative rancidity or other changes and generally to avoid loss by deterioration. Secondly, there are the substances introduced into food through processing or packaging, or present as residues from chemicals used to control diseases of plants or animals, or used to fight insect pests or weeds. As modern food technology develops and its benefits come to be applied on a wider and wider scale, so the need for careful supervision grows.

4. The number and variety of chemical substances involved presents

a bewildering array of potential toxic hazards against which the health of the consumer must be safeguarded. How may this best be done ? Like Beauty, Safety is a relative term. Just as perfect beauty, the absence of any blemish, may be only skin deep, so perfect safety is an illusion fostered by ignorance. Any form of food, however 'natural' it may be, is fraught with dangers to the consumer; hazards to health may arise in such traditional methods of preserving food as smoking and drying. In fact the very practice of eating involves so much risk that it ought to be abolished! Consideration of the extent of risk of any food chemical must take into account the potential benefits conferred by that substance. Acceptability of a substance can only be assessed in the light of the circumstances of its intended use. Since in any given instance the potential benefits may be considerably greater for a less developed area, so the criteria on which a decision regarding safety is based will inevitably be less rigid and inflexible than in western societies.

Toxicological basis for ensuring acceptability

5. At the present time we rely on animal tests to guide us in deciding whether a chemical is safe to use in food at any particular level (3) Such tests, though they have become ever more elaborate and expensive to perform, are still fraught with pitfalls and the assumption that the results apply to man is in many cases completely false. Even then our data apply to the individual compound before it has become part of the food. What about its interaction with the food components ? What about the possible degradative changes which it undergoes during cooking or other processing of the food ? What about the synergistic or other actions of several chemicals, either intentional or adventitious additives ? These and a host of other questions remain unanswered because this branch of toxicological science is in its infancy. Much fundamental research needs to be carried out before our present reliance on negative findings in rats and dogs can be replaced by a positive approach emphasizing the biological potential of a compound - its action on living cells and organized systems, described in terms of modern basic sciences, particularly Biochemistry, Pharmacology and Pathology.

6. It is to carry out fundamental research of this kind that the British Industrial Biological Research Association (B.I.B.R.A.) was founded in 1960 as a joint enterprise on the part of the British Government and British food, cosmetics, chemical and packaging manufacturers. There are studies already under way which are intended to provide rapid and efficient methods of preliminary toxicity screening for new compounds, thus helping to reduce the cost and time involved in the development of novel and potentially valuable agents. Such steps are all-important if the increasing difficulties and complexities are not to bar the way to

technological progress and ultimately to stifle research into new food additives. Other aspects of B.I.B.R.A.'s programme are concerned with liver function and its repercussions on the results of toxicity testing; with the nature and quantity of dietary fat, the storage of dietary chemicals in body fat and the effects of malnutrition, infectious and other disease processes on the hazard presented by such chemicals. The general emphasis in the past has been on tests carried out on so-called 'normal animals', with little concern for the influence of diet or environment, which can profoundly affect the outcome of tests. B.I.B.R.A. feels that the time has come for a 'new look' in the whole field of food additive toxicology and the interests of the wider world outside, especially in tropical conditions, are very much in our minds in planning this new approach.

The practical approach to safety evaluation

7. Faced with the practical problem of deciding whether a particular food additive or pesticide is acceptable when used in a specified manner, the legislator and his technical advisers have inevitably to fall back on simple rules which are readily applied. He is aware of their shortcomings but, until the current advances in basic sciences provide him with something more satisfactory, the present-day procedures must be used. It is important, however, to maintain a flexible attitude, to be ready to accept alternative approaches, and above all to mould the experimental method to the individual problem rather than try to fit each and every investigation into the same rigid petrified pattern.

8. With these provisos it can be confidently stated that the 90-day chronic test, carried out in two species of laboratory animal, will long remain the keystone of safety studies. The thoroughness with which this test is planned and conducted, the appropriate choice of levels of administration of the test substance, and the knowledge and experience brought to bear on the interpretation of the results, determine the value of the test in relation to the whole issue of safety evaluation. With a compound which is not too distantly related to accepted food additives, the 90-day test will reveal all, or practically all, that is forthcoming from an elaborate study conducted over a period of 2 years. The 90-day study avoids the complications introduced by ageing changes in rats and mice. On the other hand it provides little information on possible carcinogenic hazard. This latter issue is too vast to be discussed here (4,5,6) Nevertheless its importance to emergent countries is considerable, since lack of care and foresight to-day may only reveal itself in disastrous consequences twenty years from now. A possible manifestation of this sort of hazard is the enormously increased incidence of oesophageal cancer among the Bantu of South Africa,

particularly in the Transkei (7) Suffice it to say that the development of an accelerated test for the assessment of carcinogenicity is also one of B.I.B.R.A.'s research objectives.

9. The extrapolation of animal testing results to man is greatly facilitated by knowledge of the principal human metabolic pathways of a new compound. This then is the preferred approach, rather than longer and longer tests in more and more animals. Provided an animal species is found whose metabolism of the test substance is similar to man's, safety evaluation in this species is far more satisfactory than random testing. This is the principle adopted by B.I.B.R.A. in conducting its own routine testing programme.

Provision for future needs

10. I have tried to give some indication of the scientific complexity of the subject, to convey an impression of the interwoven pattern of scientific disciplines brought to bear on it, and of the unavoidable need for wide experience in many scientific fields in order to assess the overall significance of toxicological findings.

11. How is an emergent nation to attempt to deal with food additives, faced as it is with a multitude of far more vital problems ? One way would be to imitate what is done in the field of drugs, where the British or U.S. Pharmacopoeias are used as a yardstick. Unfortunately some almost insuperable problems arise. For instance, no two permitted lists of food additives bear even a close resemblance to one another. Quite often the experts of one country disagree with those of another. Adoption of one country's list places exporters in other countries at a considerable disadvantage and may act to the detriment of a young nation wishing to increase food supplies, to improve the general availability of good food, and to export some of its primary produce.

12. What is needed is: firstly, information, to keep the country's scientists in touch with world developments in the legislative and scientific spheres; secondly, a source of expert advice to which scientists and administrators can have ready and speedy access without the need for formality, protocol or red tape; and thirdly, testing and research facilities with first-class personnel embracing all the various disciplines involved in safety evaluation. In order to be adequate such services must include an irreducible minimum of facilities of considerable size, complexity and cost. It seems pointless that each country should duplicate all these, even if it was within its power to do so. Until such time as an international

organization can provide all these essential services, the British Industrial Biological Research Association is ready to do all it can to undertake this task. As an independent non-profit making organization, we are anxious to extend our membership overseas among the less developed areas where our efforts can bear so much fruit in terms of human welfare.

References

(1) Toxic Chemicals in Agriculture and Food Storage
Report of the Research Study Group, Ministry of Agriculture, Fisheries and Food, H.M.S.O. 1961.

(2) Hinton, C.L. Food Additive Control in the United Kingdom, FAO, Rome (1960).

(3) Procedures for the Testing of Intentional Food Additives Wld.Hlth.Org. Techn.Rep.Ser. 144 (1958).

(4) Problems in the Evaluation of Carcinogenic Hazard from Use of Food Additives, United States National Research Council, Food Protection Committee Nat.Acad.Sci.Publ., 749 (1959).

(5) Evaluation of the Carcinogenic Hazards of Food Additives, Wld.Hlth.Org. Tech.Rep.Ser. 220 (1961).

(6) Carcinogenic Risks in Food Additives and Pesticides
Reprinted from Monthly Bull. Ministry of Health and Public Health Lab.Service, 19, 108 (1960).

(7) Burrell, R.J.W. Esophageal Cancer Among Bantu in the Transkei. J.Nat.Cancer Inst., 28, 495 (1962).

335 E - Oct. 1962 - 1, 600